IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	H. Adachi et al.	: Art Unit:
Serial No.:	To Be Assigned	: Examiner:
Filed:	Herewith	:
FOR:	TRANSMITTING CIRCUIT APPARATUS	:

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

S I R :

Prior to examination, please amend the above-identified application as follows:

IN THE SPECIFICATION:

Please replace the following paragraphs:

At page 4, line 19:

One aspect of the present invention is a transmitting circuit apparatus comprising: a first digital modulator and a second digital modulator for modulating an I signal and a Q signal which are multi-valued digital baseband modulation signals, into a digital I signal and a digital Q signal, respectively, having the number of bits smaller than that of said baseband modulation signals; and a quadrature modulator for outputting a signal synthesized from the signals generated by modulating (two) carrier waves each having a phase perpendicular to each other by using said modulated I and Q signals, respectively.

At page 5, lines 6-7:

Another aspect of the present invention is a transmitting circuit apparatus, wherein said first and second digital modulators modulate said I and Q signals which are multi-valued digital baseband modulation signals into two-valued digital I and Q signals, respectively.

At page 5, lines 11-12:

Still another aspect of the present invention is a transmitting circuit apparatus, wherein each of said first and second digital modulators comprises a sigma-delta modulator of at least second order or higher.

At page 5, lines 15-16:

Yet another aspect of the present invention is a transmitting circuit apparatus, further comprising a first and a second band-pass filter for reducing unnecessary signals outside the transmission frequency band from said signals generated by modulating said carrier waves each having a phase perpendicular to each other by using said modulated I and Q signals, respectively, wherein said signals go through said first and second band-pass filters, respectively, and are then synthesized into an output signal of said quadrature modulator.

At page 5, line 25 and page 6, line 1:

Still yet another aspect of the present invention is a transmitting circuit apparatus, further comprising a band-pass filter connected to the output of said quadrature modulator and for outputting a signal after reducing unnecessary signals outside the transmission frequency band from the output signal of said quadrature modulator.

At page 6, lines 6-7:

A further aspect of the present invention is a transmitting circuit apparatus, wherein said quadrature modulator comprises a first and a second digital RF modulator each for performing amplitude modulation on each of said carrier waves having a phase perpendicular to each other, wherein said modulated I and Q signals control said first and second digital RF modulators, respectively, thereby to perform step-like amplitude modulation on said carrier waves, wherein

the modulated signals are synthesized into a signal, and wherein the signal is then output.

At page 6, lines 16-17:

A still further aspect of the present invention is a transmitting circuit apparatus, wherein each of said first and second digital RF modulators comprises a power amplifier, wherein each of said modulated I and Q signals controls the power supply of each of said power amplifiers thereby to perform amplitude modulation on each of said carrier waves, and wherein said amplitude-modulated signals are synthesized into an output signal of said quadrature modulator.

At page 6, lines 24-25:

A yet further aspect of the present invention is a transmitting circuit apparatus, wherein each of said first and second digital RF modulators comprises an amplitude modulator and a power amplifier, wherein each of said carrier waves is modulated using each of said modulated I and Q signals by each of said amplitude modulators, and then amplified by each of said power amplifiers, and wherein said amplified signals are synthesized into an output signal of said quadrature modulator.

At page 7, lines 7-8:

A still yet further aspect of the present invention is a transmitting circuit apparatus, wherein each of said first and second digital modulators comprises a power amplifier composed of a dual gate FET, wherein each of said carrier waves is input to the first gate of each of said dual gate FET's, wherein each of said modulated I and Q signals controls the output signal of each of said power amplifiers via the second gate terminal of the dual gate FET thereby to perform amplitude modulation on each of said carrier waves, and wherein said amplitude-modulated signals are synthesized into an output signal of said quadrature modulator.

At page 7, lines 18-19:

An additional further aspect of the present invention is a transmitting circuit apparatus, wherein each of said power amplifiers constitutes a final

amplifying stage, and hence no amplification circuit for the transmission signal is provided in the circuit in the stages after the quadrature modulator.

At page 7, lines 24-25:

A still additional further aspect of the present invention is a transmitting circuit apparatus, comprising: E/O converters each for converting the output signal of each of said first and second digital modulators into an optical signal having a wavelength different from each other; and O/E converters each for converting the optical signal transferred from each of said E/O converters into an electric signal; wherein the output signal of each of said O/E converters is input to said quadrature modulator thereby to perform amplitude modulation on each of said carrier waves.

At page 8, lines 9-10:

A yet additional aspect of the present invention is a transmitting circuit apparatus, wherein said digital I and Q signals converted into optical signals each having a different wavelength are transferred through a common optical fiber.

At page 8, lines 14-15;

A still yet additional aspect of the present invention is a transmitting circuit apparatus, wherein each of said carrier waves is generated from the digital I or Q signal having been restored into an electric signal by each of said O/E converters.

At page 8, lines 19-20:

A supplementary additional aspect of the present invention is a transmitting circuit apparatus, further comprising: another E/O converter for converting the output signal of a reference signal source into an optical signal having a wavelength different from those of the optical signals of said digital I and Q signals; and an O/E converter for converting the optical signal transferred from said E/O converter into an electric signal; wherein said carrier waves are generated from the output signal of said O/E converter.

At page 9, lines 3-4:

A still supplementary aspect of the present invention is a transmitting circuit apparatus, wherein each of said sigma-delta modulators comprises an n-th-order integrator, a quantizer, and a feedback circuit, wherein a value input to said n-th-order integrator undergoes n-th-order integration and is then input to said quantizer thereby to be quantized into a digital value, wherein said quantized value serves as the output signal of said sigma-delta modulator, and at the same time, is input to said feedback circuit, and wherein the output signal of said feedback circuit is added to the input value of said sigma-delta modulator and the result is input to said n-th-order integrator.

At page 9, lines 15-17:

A yet supplementary aspect of the present invention is a transmitting circuit apparatus, wherein each of said sigma-delta modulators comprises a plurality of lower-order sigma-delta modulators connected in multi-stage, wherein the output signal of each of said plurality of lower-order sigma-delta modulators is synthesized by connecting the output to a differentiator having a configuration expressed by a z transform

At page 9, line 25 and page 10, lines 1-2:

A still yet supplementary aspect of the present invention is a transmitting circuit apparatus, wherein the output of each of said first and second sigma-delta modulators is provided with a digital filter having low-pass characteristics.

CLAIMS:

Please replace claims 4-6, 10-11 and 13-17 with the following:

4. (Amended) A transmitting circuit apparatus of any one of Claims 1 or 2, further comprising a first and a second band-pass filter for reducing unnecessary signals outside the transmission frequency band from said signals generated by modulating said carrier waves each having a phase perpendicular to each other by using said modulated I and Q signals, respectively, wherein said signals go through said first and second band-pass filters, respectively, and are then synthesized into an output signal of said quadrature modulator.

5. (Amended) A transmitting circuit apparatus of any one of Claims 1 or 2, further comprising a band-pass filter connected to the output of said quadrature modulator and for outputting a signal after reducing unnecessary signals outside the transmission frequency band from the output signal of said quadrature modulator.

6. (Amended) A transmitting circuit apparatus of any one of Claims 1 or 2, wherein said quadrature modulator comprises a first and a second digital RF modulator each for performing amplitude modulation on each of said carrier waves having a phase perpendicular to each other, wherein said modulated I and Q signals control said first and second digital RF modulators, respectively, thereby to perform step-like amplitude modulation on said carrier waves, wherein the modulated signals are synthesized into a signal, and wherein the signal is then output.

10. (Amended) A transmitting circuit apparatus of Claim 7, wherein each of said power amplifiers constitutes a final amplifying stage, and hence no amplification circuit for the transmission signal is provided in the circuit in the stages after the quadrature modulator.

11. (Amended) A transmitting circuit apparatus of any one of Claims 1 or 2, comprising: E/O converters each for converting the output signal of each of said first and second digital modulators into an optical signal having a wavelength different from each other; and O/E converters each for converting the optical signal transferred from each of said E/O converters into an electric signal; wherein the output signal of each of said O/E converters is input to said quadrature modulator thereby to perform amplitude modulation on each of said carrier waves.

13. (Amended) A transmitting circuit apparatus of Claim 11, wherein each of said carrier waves is generated from the digital I or Q signal having been restored into an electric signal by each of said O/E converters.

14. (Amended) A transmitting circuit apparatus of Claim 11, further comprising: another E/O converter for converting the output signal of a reference signal source into an optical signal having a wavelength different from those of the optical signals of said digital I and Q signals; and an O/E converter for converting the optical signal transferred from said E/O converter into an electric

signal; wherein said carrier waves are generated from the output signal of said O/E converter.

15. (Amended) A transmitting circuit apparatus of Claim 3, wherein each of said sigma-delta modulators comprises an n-th-order integrator, a quantizer, and a feedback circuit, wherein a value input to said n-th-order integrator undergoes n-th-order integration and is then input to said quantizer thereby to be quantized into a digital value, wherein said quantized value serves as the output signal of said sigma-delta modulator, and at the same time, is input to said feedback circuit, and wherein the output signal of said feedback circuit is added to the input value of said sigma-delta modulator and the result is input to said n-th-order integrator.

16. (Amended) A transmitting circuit apparatus of Claim 3, wherein each of said sigma-delta modulators comprises a plurality of lower-order sigma-delta modulators connected in multi-stage, wherein the output signal of each of said plurality of lower-order sigma-delta modulators is synthesized by connecting the output to a differentiator having a configuration expressed by a z transform

$$(1-z^{-1})^m$$

with the degree m up to the preceding stage.

17. (Amended) A transmitting circuit apparatus of Claim 3, wherein the output of each of said first and second sigma-delta modulators is provided with a digital filter having low-pass characteristics.

Respectfully Submitted,

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Kathleen Libby

VERSION WITH MARKINGS TO SHOW CHANGES MADE

SPECIFICATION:

At page 4, line 19:

~~The 1st invention~~One aspect of the present invention is a transmitting circuit apparatus comprising: a first digital modulator and a second digital modulator for modulating an I signal and a Q signal which are multi-valued digital baseband modulation signals, into a digital I signal and a digital Q signal, respectively, having the number of bits smaller than that of said baseband modulation signals; and a quadrature modulator for outputting a signal synthesized from the signals generated by modulating (two) carrier waves each having a phase perpendicular to each other by using said modulated I and Q signals, respectively.

At page 5, lines 6-7:

~~The 2nd invention~~Another aspect of the present invention is a transmitting circuit apparatus ~~of 1st invention~~, wherein said first and second digital modulators modulate said I and Q signals which are multi-valued digital baseband modulation signals into two-valued digital I and Q signals, respectively.

At page 5, lines 11-12:

~~The 3rd invention~~Still another aspect of the present invention is a transmitting circuit apparatus ~~of 1st or 2nd inventions~~, wherein each of said first and second digital modulators comprises a sigma-delta modulator of at least second order or higher.

At page 5, lines 15-16:

~~The 4th invention~~Yet another aspect of the present invention is a transmitting circuit apparatus ~~of any one of 1st to 3rd inventions~~, further comprising a first and a second band-pass filter for reducing unnecessary signals outside the transmission frequency band from said signals generated by modulating said carrier waves each having a phase perpendicular to each other by using said modulated I and Q signals, respectively, wherein said signals go through said first and second band-pass filters, respectively, and are then synthesized into an output signal of said quadrature modulator.

At page 5, line 25 and page 6, line 1:

~~The 5th invention~~Still yet another aspect of the present invention is a transmitting circuit apparatus ~~of any one of 1st to 3rd inventions~~, further comprising a band-pass filter connected to the output of said quadrature modulator and for outputting a signal after reducing unnecessary signals outside the transmission frequency band from the output signal of said quadrature modulator.

At page 6, lines 6-7:

~~The 6th invention~~A further aspect of the present invention is a transmitting circuit apparatus ~~of any one of 1st to 5th inventions~~, wherein said quadrature modulator comprises a first and a second digital RF modulator each for performing amplitude modulation on each of said carrier waves having a phase perpendicular to each other, wherein said modulated I and Q signals control said first and second digital RF modulators, respectively, thereby to perform step-like amplitude modulation on said carrier waves, wherein the modulated signals are synthesized into a signal, and wherein the signal is then output.

At page 6, lines 16-17:

~~The 7th invention~~A still further aspect of the present invention is a transmitting circuit apparatus ~~of 6th invention~~, wherein each of said first and second digital RF modulators comprises a power amplifier, wherein each of said modulated I and Q signals controls the power supply of each of said power amplifiers thereby to perform amplitude modulation on each of said carrier waves, and wherein said amplitude-modulated signals are synthesized into an output signal of said quadrature modulator.

At page 6, lines 24-25:

~~The 8th invention~~A yet further aspect of the present invention is a transmitting circuit apparatus ~~of 6th invention~~, wherein each of said first and second digital RF modulators comprises an amplitude modulator and a power amplifier, wherein each of said carrier waves is modulated using each of said modulated I and Q signals by each of said amplitude modulators, and then amplified by each of said power amplifiers, and wherein said amplified signals are synthesized into an output signal of said quadrature modulator.

At page 7, lines 7-8:

~~The 9th invention~~A still yet further aspect of the present invention is a transmitting circuit apparatus ~~of 6th invention~~, wherein each of said first and second digital modulators comprises a power amplifier composed of a dual gate FET, wherein each of said carrier waves is input to the first gate of each of said dual gate FET's, wherein each of said modulated I and Q signals controls the output signal of each of said power amplifiers via the second gate terminal of the dual gate FET thereby to perform amplitude modulation on each of said carrier waves, and wherein said amplitude-modulated signals are synthesized into an output signal of said quadrature modulator.

At page 7, lines 18-19:

~~The 10th invention~~An additional further aspect of the present invention is a transmitting circuit apparatus ~~of any one of 7th to 9th inventions~~, wherein each of said power amplifiers constitutes a final amplifying stage, and hence no amplification circuit for the transmission signal is provided in the circuit in the stages after the quadrature modulator.

At page 7, lines 24-25:

~~The 11th invention~~A still additional further aspect of the present invention is a transmitting circuit apparatus ~~of any one of 1st to 10th inventions~~, comprising: E/O converters each for converting the output signal of each of said first and second digital modulators into an optical signal having a wavelength different from each other; and O/E converters each for converting the optical signal transferred from each of said E/O converters into an electric signal; wherein the output signal of each of said O/E converters is input to said quadrature modulator thereby to perform amplitude modulation on each of said carrier waves.

At page 8, lines 9-10:

~~The 12th invention~~A yet additional aspect of the present invention is a transmitting circuit apparatus ~~of 11th invention~~, wherein said digital I and Q signals converted into optical signals each having a different wavelength are transferred through a common optical fiber.

At page 8, lines 14-15;

~~The 13th invention~~A still yet additional aspect of the present invention is a transmitting circuit apparatus ~~of 11th or 12th inventions~~, wherein each of said carrier waves is generated from the digital I or Q signal having been restored into an electric signal by each of said O/E converters.

At page 8, lines 19-20:

~~The 14th invention~~A supplementary additional aspect of the present invention is a transmitting circuit apparatus ~~of 11th or 12th inventions~~, further comprising: another E/O converter for converting the output signal of a reference signal source into an optical signal having a wavelength different from those of the optical signals of said digital I and Q signals; and an O/E converter for converting the optical signal transferred from said E/O converter into an electric signal; wherein said carrier waves are generated from the output signal of said O/E converter.

At page 9, lines 3-4:

~~The 15th invention~~A still supplementary aspect of the present invention is a transmitting circuit apparatus ~~of any one of 3rd to 14th inventions~~, wherein each of said sigma-delta modulators comprises an n-th-order integrator, a quantizer, and a feedback circuit, wherein a value input to said n-th-order integrator undergoes n-th-order integration and is then input to said quantizer thereby to be quantized into a digital value, wherein said quantized value serves as the output signal of said sigma-delta modulator, and at the same time, is input to said feedback circuit, and wherein the output signal of said feedback circuit is added to the input value of said sigma-delta modulator and the result is input to said n-th-order integrator.

At page 9, lines 15-17:

~~The 16th invention~~A yet supplementary aspect of the present invention is a transmitting circuit apparatus ~~of any one of 3rd to 15th inventions~~, wherein each of said sigma-delta modulators comprises a plurality of lower-order sigma-delta modulators connected in multi-stage, wherein the output signal of each of said plurality of lower-order sigma-delta modulators is synthesized by

connecting the output to a differentiator having a configuration expressed by a z transform

At page 9, line 25 and page 10, lines 1-2:

~~The 17th invention~~A still yet supplementary aspect of the present invention is a transmitting circuit apparatus ~~of any one of 3rd to 16th inventions~~, wherein the output of each of said first and second sigma-delta modulators is provided with a digital filter having low-pass characteristics.

CLAIMS:

4. (Amended) A transmitting circuit apparatus of any one of Claims 1 ~~to 3~~or 2, further comprising a first and a second band-pass filter for reducing unnecessary signals outside the transmission frequency band from said signals generated by modulating said carrier waves each having a phase perpendicular to each other by using said modulated I and Q signals, respectively, wherein said signals go through said first and second band-pass filters, respectively, and are then synthesized into an output signal of said quadrature modulator.

5. (Amended) A transmitting circuit apparatus of any one of Claims 1 ~~to 3~~or 2, further comprising a band-pass filter connected to the output of said quadrature modulator and for outputting a signal after reducing unnecessary signals outside the transmission frequency band from the output signal of said quadrature modulator.

6. (Amended) A transmitting circuit apparatus of any one of Claims 1 ~~to 5~~or 2, wherein said quadrature modulator comprises a first and a second digital RF modulator each for performing amplitude modulation on each of said carrier waves having a phase perpendicular to each other, wherein said modulated I and Q signals control said first and second digital RF modulators, respectively, thereby to perform step-like amplitude modulation on said carrier waves, wherein the modulated signals are synthesized into a signal, and wherein the signal is then output.

10. (Amended) A transmitting circuit apparatus of ~~any one of~~ Claims ~~7 to 9~~, wherein each of said power amplifiers constitutes a final amplifying

stage, and hence no amplification circuit for the transmission signal is provided in the circuit in the stages after the quadrature modulator.

11. (Amended) A transmitting circuit apparatus of any one of Claims 1 ~~to 10~~or 2, comprising: E/O converters each for converting the output signal of each of said first and second digital modulators into an optical signal having a wavelength different from each other; and O/E converters each for converting the optical signal transferred from each of said E/O converters into an electric signal; wherein the output signal of each of said O/E converters is input to said quadrature modulator thereby to perform amplitude modulation on each of said carrier waves.

13. (Amended) A transmitting circuit apparatus of Claim 11 ~~or 12~~, wherein each of said carrier waves is generated from the digital I or Q signal having been restored into an electric signal by each of said O/E converters.

14. (Amended) A transmitting circuit apparatus of Claim 11 ~~or 12~~, further comprising: another E/O converter for converting the output signal of a reference signal source into an optical signal having a wavelength different from those of the optical signals of said digital I and Q signals; and an O/E converter for converting the optical signal transferred from said E/O converter into an electric signal; wherein said carrier waves are generated from the output signal of said O/E converter.

15. (Amended) A transmitting circuit apparatus of ~~any one of~~ Claims 3 ~~to 14~~, wherein each of said sigma-delta modulators comprises an n-th-order integrator, a quantizer, and a feedback circuit, wherein a value input to said n-th-order integrator undergoes n-th-order integration and is then input to said quantizer thereby to be quantized into a digital value, wherein said quantized value serves as the output signal of said sigma-delta modulator, and at the same time, is input to said feedback circuit, and wherein the output signal of said feedback circuit is added to the input value of said sigma-delta modulator and the result is input to said n-th-order integrator.

16. (Amended) A transmitting circuit apparatus of ~~any one of~~ Claims 3 ~~to 15~~, wherein each of said sigma-delta modulators comprises a plurality of lower-order sigma-delta modulators connected in multi-stage, wherein the

output signal of each of said plurality of lower-order sigma-delta modulators is synthesized by connecting the output to a differentiator having a configuration expressed by a z transform

$$(1-z^{-1})^m$$

with the degree m up to the preceding stage.

17. (Amended) A transmitting circuit apparatus of ~~any one of~~ Claims 3 ~~to 16~~, wherein the output of each of said first and second sigma-delta modulators is provided with a digital filter having low-pass characteristics.